

REMARKS

Claims 1-15 are pending in this application. By this Amendment, claims 1-5, 9 and 13 are amended. No new matter is added.

I. Claim Objections

Claims 1-5, 9 and 13 are objected to for minor informalities. As the claims are amended as suggested in the Office Action, Applicants respectfully request the objection to claims 1-5, 9 and 13 be withdrawn.

II. Claim Rejections Under 35 U.S.C. §112

Claims 2 and 5 are rejected under 35 U.S.C. §112, second paragraph. Claims 2 and 5 are amended in response to the rejection, thus Applicants respectfully request the rejection of claims 2 and 5 under 35 U.S.C. §112, second paragraph, be withdrawn. Claim 2 has been amended to "the metal material article" as it means a metal article to be treated by performing an electrolytic treatment and "the ions" are those dissolved in the treatment bath.

III. Claim Rejections Under 35 U.S.C. §103

Claims 1-15 are rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 5,645,706 to Matsuda. The rejection is respectfully traversed.

Applicants assert that Matsuda does not disclose or suggest each and every feature recited in the rejected claims. For example, Matsuda does not disclose an electrolytic phosphate chemical treatment method of forming a film composed of a phosphate compound and a metal that is reduced and precipitated from an ionic state on the surface of a metal material article to be treated, comprising *inter alia* ... a phosphate chemical treatment bath containing phosphate ions, phosphoric acid, nitrate ions, metal ions that form a complex with the phosphate ions in the phosphate chemical treatment bath, and metal ions for which the dissolution-precipitation equilibrium potential at which the metal ions dissolved in the phosphate chemical treatment bath are reduced and precipitate as metal is equal to or greater

than -830 mV, which is the cathodic reaction decomposition potential of water when indicated as the hydrogen standard electrode potential, and is substantially free of metal ions other than those which are a component of the film, as recited in independent claim 1.

Rather, Matsuda discloses an electrolytic treatment using a conventional non-electrolytic treatment bath. For example, Matsuda recites "the present invention is limited only to soluble components (H_3PO_4 , NO_3^- , HNO_2 , metal ions such as Zn^{2+} , etc.) with no sludge, in chemical treatment baths, and the substance to be treated in the electrode are placed in the treatment bath and an external power source connected between them, thus applying an electrical current between the substance to be treated (workpiece) and electrode. Further the phosphate chemical treatment bath is controlled so that sludge is not produced therein" (col. 7, lines 37-45). Matsuda also discloses that increasing the pH is accomplished by introducing a chemical, such as caustic soda which will shift the treatment bath towards the alkaline end of the pH scale (col. 14, lines 29-34). Thus, Matsuda discloses that the phosphate chemical treatment bath contains soluble metal ions, such as Na^+ derived from caustic soda. Furthermore, in all examples provided in Matsuda an accelerator is used and the accelerator concentration is provided free acidity is in the range of 0.1 to 2.4 pt. This range is necessary for a conventional non-electrolytic treatment bath.

Additionally, in Matsuda there is an extreme shortage of anions in the treatment bath. Thus, Matsuda is using a conventional non-electrolytic treatment bath and therefore sludge is unavoidably formed in such a conventional non-electrolytic treatment bath. However, Matsuda discloses that the treatment method used 1) the removal of solid matter (sludge) from a chemical treatment bath and 2) an external electric power source for the reaction) (See, for example, col. 6, lines 29-37).

Although Na-containing compounds are used as a pH modulator and accelerator in Matsuda, the concentration of sodium ion (Na^+) is not indicated with respect to the

composition of the treatment bath because Na^+ is not directly related to the chemical treatment reaction (film formation). Thus, Matsuda fails to disclose a phosphate chemical treatment bath which is substantially free of metal ions other than those which are a component of the film, as recited in the rejected claims, because the bath of Matsuda contains Na^+ which is a metal ion other than an ion which is a component of the film.

Regarding the rejection of claim 2, the Office Action indicates that Matsuda discloses that the metal ions that form the complex with the phosphoric acid and the phosphate ions in the phosphate chemical treatment bath are at least one of Zn, Fe, Mn or Ca ions and that those ions would have also been those ions for which the dissolution-precipitation equilibrium potential is equal to or greater than -830 mV. However, it should be noted that col. 2, lines 46-52 of Matsuda indicates that the chemical treatment solutions used are aqueous phosphate solutions containing coat-forming metal ions, such as iron, manganese, nickel, calcium, zinc, etc. A film of nickel phosphate is not formed by a common phosphate chemical treatment. Nickel ion is reduced and precipitates as a metal film and hence does not constitute a phosphate chemical film. In other words, a chemical reaction for precipitation of a phosphate is different from that for precipitation of a metal by reduction. When a phosphate is precipitated by ionic bonding an electric charge of the metal ion is unchanged. In contrast, when metal ions are reduced to precipitate as metal, the electric charge is changed.

Furthermore, reduction of metal ions is affected by a decomposition of water. Therefore, a metal which can precipitate is one which has the dissolution-precipitation equilibrium potential of greater than or equal to -830 mV, which is the cathodic reaction decomposition potential of water. When a metal has the dissolution-precipitation equilibrium potential of less than -830 mV, water is decomposed and metal ions cannot be reduced to precipitate as metal. The manganese and calcium which are set forth in Matsuda have the dissolution-precipitation equilibrium potential of less than -1.18 and -1.84 volts, respectively.

Manganese and nickel are precipitated as a phosphate with the electric charge unchanged and are not affected by a decomposition of water.

Regarding claim 3, Matsuda discloses that if the treatment bath contains Fe^{3+} , it has an ORP of 560 mV (which corresponds to 770 mV in terms of the standard hydrogen electrode potential) or greater. If the treatment bath does not contain Fe^{3+} , it has an ORP of less than 560 mV. Thus, if a treatment bath has an ORP of less than 770 mV then Fe^{2+} exists, and when the treatment bath has an ORP of equal to or greater than 770 mV then Fe^{3+} exists.

Thus, Applicants submit that Matsuda fails to teach any relationship between the ORP and the sludge content. Rather, Matsuda merely discloses that an ORP of equal to or greater than 770 mV can be accomplished in an electrolytic treatment bath while it cannot be accomplished in a non-electrolytic treatment bath (see, for example, col. 13, lines 27-47). Additionally, Matsuda discloses that at 250 mV (which corresponds to 460 mV in terms of the standard hydrogen electrode potential) or less, and sludge is then easily produced. Thus, Matsuda fails to disclose or suggest maintaining an ORP of equal to or greater than 770 mV in the treatment bath.

Regarding claim 6, in Matsuda, an FE-phosphate complex is assumed to be " Fe^{2+} - H_2PO_4 ". If such an FE-complex were to be replenished in a treatment bath having an ORP of equal to or greater than 700 mV, the ORP would be decreased.

Regarding claim 9, the Office Action alleges that Matsuda discloses NO, NO_2 and/or N_2O_4 gases generated and dissolved in a treatment tank. However, the equation relied upon in Matsuda shows HNO_2 being reduced to $\text{NO} + \text{H}_2\text{O}$. HNO_2 cannot exist in a gaseous form and can exist only as HNO_2 which is dissolved in water. Thus, the nitrogen oxide described in the equation in Matsuda is only NO. Thus, Matsuda does not disclose all of the features recited in claim 9.

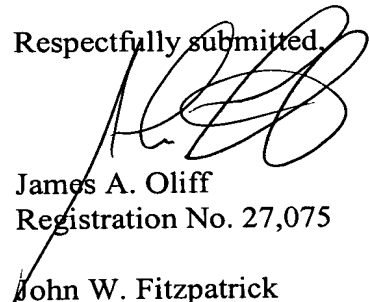
Accordingly, Applicants respectfully request the rejection of claims 1-15 under 35 U.S.C. §103(a) be withdrawn.

IV. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-15 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,


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Attachment:
Petition for Extension of Time

Date: July 15, 2004

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